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ABSTRACT

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R. C. Swank

Abstract

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R. C. Swank

The purpose of this paper is to state the principal issues and parameters of concern at this conference on interlibrary communications and information networks. As I conceive my task, I should map the entire field of our concerns and describe in general terms its topography. I should not analyze specific problem areas, offer solutions, or recommend plans for action. These are the tasks of the papers that will follow.

Definitions

I will begin with definitions of information and communications networks. In my review of the literature--the literature specific to this definition is very recent and sparse--I found the most help in the publications of Carl Overhage, Joe Becker, and Launor Carter.

Overhage identified five different contexts in which the term "networks" is used.[1] The first is "science literature," as in networks of citation-linked papers. The second is "organization structures," as in the ERIC clearinghouses. The third is "cooperative arrangements," as in interlibrary loans. The fourth is "communications systems," as in press wire services. And the fifth is "computer-communications systems," as in the NASA Recon system. He went on, then, to explain that, while networks of scientific literature, of organizational structures, and of libraries are all important, none specifically characterizes the communications links to be used. The primary topic of his annual review of

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[1] Carl F. J. Overhage, "Information Networks," in American Society for Information Science, Annual Review of Information Science and Technology, v. 4. (Chicago: Encyclopedia Britannica, 1969), p. 339-44.

"information networks" was networks of communications and of computer-communications systems, which do specify the use of electric signal transmission. For the purpose of his paper, therefore, he adopted the following definition: "...when these [communications] channels are used for the transfer of certain categories of information they are customarily said to constitute an information network. In this usage...the essential feature of an information network is the utilization of a set of communications channels through which the information is transferred by electric signals."[2]

Becker and Olsen also noted the varieties of contexts in which the term "network" is used, then divided the definitions first by class of equipment, as in telephone, teletype, facsimile, and computer networks; second by form of data, as in digital, audio, video and film networks; and third by functions, as in financial, library, education, and management networks. He continued: "Information networks include some combination of the above three elements, which when coupled with a communications system, provide the desired pattern of information exchange."[3] The main concepts of an automated information network--and he pointed out that none yet existed--would be:

1. Formal Organization. Many units sharing a common information purpose recognize the value of group affiliation and enter into a compact.
2. Communications. The network includes circuits that can rapidly interconnect dispersed points.

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[2]Ibid., p. 339.

[3]Joseph Becker and Wallace C. Olsen, "Information Networks," in American Society of Information Science, Annual Review of Information Science and Technology, v. 3 (Chicago: Encyclopedia Britannica, 1968), p. 290-91.

3. Bidirectional Operation. Information may move in either direction, and provision is made for each network participant to send as well as receive.
4. A Directory and Switching Capability. A directory look-up system enables a participant to identify the unit most able to satisfy a particular request. A switching center then routes messages to this unit over the optimum communications path.[4]

Becker and Olsen then noted that the word network is also widely applied to "the banding together of existing information systems into some type of communications cooperative, e.g., referral centers, information analysis centers, industrial departments, airline tickets offices, and police precincts, in order to satisfy a functional goal."[5]

Carter took a somewhat different line, in that he introduced the data base and remote users into his definition.

> An information network, or a library network, I think, has the following characteristics. First we have two or more nodes, or centers of intercommunication and of data bases. One node or center, by itself, is not a network... . The nodes are interconnected and are able to use each other's data bases, and that is very important. Each node has a unique data base or capability--in terms of a bibliographical apparatus, in terms of unique holdings, in terms of the power of the computer center--and each one is able to call upon the others for assistance. You have nodes, then, which are interconnected by communications, and that is my second

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[4] Ibid.

[5] Ibid.

point. Third, each node in this system has remote users--the users are quite separated from the nodal center. Nodes in, say, Olympia, Bellingham, Hoquiam, Vancouver, Spokane, etc., could all be switched more or less automatically to a node in, say, Seattle or some other place. Those, then, are the three characteristics I think of a network as having: It has nodes, with a unique data base at each node; it is of course electronically switchable and has high-speed communications; and it has remote users.[6]

For the purpose of balance, let me add a definition that I used in 1967 with reference not to any particular class of communications equipment or type of data but to what Becker and Olsen called the banding together of existing information systems, in this case libraries and information centers.

The network concept includes the development of cooperative systems of libraries on geographical, subject, or other lines, each with some kind of center that not only coordinates the internal activities of the system but also serves as the system's outlet to, and inlet from, the centers of other systems. The concept is also hierarchical in that the centers of smaller systems are channels to centers of larger networks at state, national, and even international levels. A familiar analogy is the telephone service, in which local systems were first coordinated and then hooked up into national and international networks.[7]

Overhage, Becker and Olsen, and Carter, while acknowledging the importance

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[6]Launor F. Carter, "What are the Major National Issues in the Development of Library Networks," News Notes of California Libraries 63: 406-07 (Fall 1968).

[7]R. C. Swank, Interlibrary Cooperation under Title III of the Library Services and Construction Act...(Sacramento: California State Library, 1967), p. 51.

of networks of existing library and information systems, as in my definition above, all defined information networks in the modern sense as utilizing communications by electronic signal transmission. This is appropriate, I think, as an ideal. I do not think, however, that we should limit our discussions to networks that specify particular types of communications channels, for two reasons. First, many of the evolving networks of existing library and information systems tend toward that ideal. In mixed ways, and in varying degrees, they do use electric signal communications through telephones, teletype, and sometimes computer applications, and they are doing so increasingly. Second, overemphasis on the communications technology sometimes obscures other essential components of information services that are not dependent, strictly speaking, upon any particular technology. For example, Becker and Olsen included "a directory look-up system" in their definition. This to me is an understatement of the central problem of the intellectual organization of documents and data, a problem that grows more and more crucial as information systems are elaborated into networks. Carter included the "data base" in his definition, and this is an abstraction of the tremendous problems of the selection, acquisition, and purging of the information resources to which access is the very reason for networks. Carter also included "remote users," which leads us again into the maze of user studies--the audiences to which network services should be addressed and the needs to be met. The technology changes and grows more powerful, but these problems remain essentially unchanged. The more widely our networks spread, the greater should be our concern about these indispensable components of all library and other information services.

I like to think of library and other information services as extensions of the home, the office, or the personal library. There a man collects his books, journals, and data files, according to his own wishes. When he has enough that he can't readily find what he wants, he begins to organize his collections--to

arrange them systematically on the shelves and in file drawers and to make catalogs and indexes. The breadth and variety of the data bases that are accessible to him are then extended stage by stage through local libraries, information centers, and other communications channels to regional systems and national networks until ideally he should have the world's knowledge at his finger tips. The extensions of his data base are accompanied by corresponding extensions of his powers of analysis through increasingly more comprehensive and sensitive schemes for the intellectual organization of that knowledge. The methods by which he can get his hands on the desired materials--that is, gain physical access--are similarly extended. To accomplish these extensions, larger organizational units of service are created, and new technologies are brought to bear upon the data bases, the schemes of intellectual access, and the methods of physical access. At every stage along the way there is a shifting balance between what the user does for himself and what the system does for him. There are trade-offs between values gained and values lost, as well as between cost and effectiveness. But the perfect information network would be the one that took us full circle to the personal library again--that would make the world's knowledge an extension of his private collection, that would give him intellectual access to the whole of it at home, and that would put copies of anything he wants on his own desk.

In this perspective, the modern information network would be new and different primarily in its technological power to extend tremendously a set of elemental functions that started at home, that are running the gamut of library and information systems and networks, and that ought sometime to end at home. So let me define an information network, for present purposes, as having these characteristics:

1. Information resources. Collections of documents or data in whatever medium. The data bases. The input.
2. Readers or users, usually remote from the main sources of information.

3. Schemes for the intellectual organization of documents or data, as directories for use by readers or users.
4. Methods for the delivery of resources to readers or users. The output.
5. Formal organization of cooperating or contracting information agencies, representing different data bases and/or groups of users.
6. Bidirectional communications networks, preferably through high-speed, long-distance electrical signal transmission with switching capabilities and computer hook-ups.

These are the broad areas of concern at this conference, and I will organize the rest of this paper around them.

The Information Resource

I tried once before to say in the most general terms what this commodity, the information resource, is as it relates to the library and information needs of society.[8] What is it that we collect, store, organize and disseminate? We may think of it as books, journals, or other texts; as audio or visual documents; or as smaller units of information or data that can be separately manipulated, as by a computer. All of these forms of records comprise parts of the information resource; but it is helpful, I think, to perceive that recorded resources are still only a part of a society's general cultural resource, which consists of an accumulation of concepts, habits, skills, arts, instruments, institutions, etc., that are handed down and built upon by each generation. I suspect that much of the learning of mankind has been forgotten, and has had to be relearned many times, if it was worth knowing in the first place. What is worth remembering comes down

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[8] R. C. Swank, "Partnerships in California: How Can Books and Information Be Mobilized for Every Californian," News Notes of California Libraries 63: 419-28 (Fall, 1968).

to us through many channels--our parents, teachers, and friends; our churches and other social institutions; our manners and customs; our folk tales and arts; and our radio and television channels. In advanced societies, a substantial part of the culture also comes down to us in recorded forms of one kind or another, and this is the part that concerns information networks.

I put the matter this way in order to emphasize the crucial role that recorded knowledge plays in advanced societies. Let us hypothesize that the more advanced the society, or the greater the totality of learning, the greater is the dependence upon the record for access to that learning. A person, or all the persons in a society, can carry only so much of it in mind; for the rest they must call upon the record. And the proportion of the total that can be recalled only from the record is ever increasing. Let us hypothesize further that no society can advance beyond a certain point without effective access to its collective memory of record; or, conversely, that an advanced society that loses control of the record will regress. In this perspective, modern information networks could be seen as a late high refinement of societies that depend increasingly upon recorded information for their further advancement.

This basic concern about the social significance of information in recorded form should not, however, be misconstrued as requiring the preservation of the totality of recorded information. A great deal of learning, whether recorded or not, has deservedly been forgotten throughout history, and the act of recording does not of itself make a piece of learning more deserving of preservation. There is a concern, then, about the problem of completeness. The goal of complete coverage of foreign materials of scholarly interest is found in the Farmington Plan and the Shared Cataloging Program under Title IIC of the Higher Education Act.[9] A report of the Committee on Scientific and Technical Information (COSATI)

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[9]John G. Lorenz, "Networks for Knowledge," Mountain-Plains Library Quarterly 14: 3-6 (Spring, 1969).

urged that it be "...the Federal Government's responsibility to insure that there exists within the United States at least one accessible copy of each significant publication of world-wide scientific and technical literature.[10] These are reasonably qualified goals, far short of the totality of recorded information. Carter seriously questioned the need of anyone, including scholars, to know the holdings of every library in the country and suggested that information networks be confined to selected research libraries. A nationally integrated computer network might not be required at all, except in certain discipline oriented fields.[11]

The further problem of preserving the totality of unrefined data, as against published documents, in recorded form was dramatically illustrated by James Fava in his account of the massive amounts of raw data accumulated by the space programs.[12] On the one hand, as in archival administration, large packages of related data might have to be calendared as a whole; and, on the other hand, a line might have to be drawn somewhere between the potentially infinite floods of raw data and the generalizable products of that data, after compacting, editing, correcting, merging, and interpretation--that is, between the raw data and the eventually published document. Total access to uninterpreted data appears to be a vastly greater chimera than that to unevaluated publications. But still, within narrowly specialized communities of scholars, continuing access to raw data for the purpose of reanalysis and reinterpretation could be essential until

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[10] A. G. Hoshovsky, "COSATI Information Studies--What Results," in American Society for Information Science, Proceedings, v. 6, Cooperating Information Societies... 32nd Annual Meeting, San Francisco, California, Oct. 1-4, 1969 (Westport, Conn.: Greenwood Publishing Corp., 1969), p. 402.

[11] Carter, "What Are the Major National Issues...," p. 415-16.

[12] James A. Fava, "A Framework for Future Data Centers," in American Society for Information Science, Proceedings, v. 6, Cooperating Information Societies...32nd Annual Meeting, San Francisco, California, Oct. 1-4, 1969 (Westport, Conn.: Greenwood Publishing Corp., 1969), p. 417. The data, for example, of one ionospheric experiment is stored on 340,000 linear feet of microfilm.

better data are produced.

There is the further concern that the information resource, as we should be viewing it, includes documents, or records, in all media.[13] Printed documents, yes, but also audio records, as in discs and tapes; video records, as in films, slides, and tapes; and digital records, as in cores, tapes, and discs. The recording media are being increasingly varied by technological extensions of the written word, the picture, and the sound. We need to insure that information networks of the future are flexible enough to embrace all forms of record that are useful to society.

Here are three major concerns, then, about the information resource:

1. The general nature and significance of the recorded information resource to society.
2. The completeness with which the information resource can be usefully acquired and stored for future access through information networks.
3. The varieties of recording media that are utilized as information resources by information networks.

Users

In the broad area of the users of information network services, we are concerned primarily with the increasing numbers of users and the growing varieties of their needs, the rights of people to equal access to information services (including realistic access at local points of service), the categories of people to be served, and the general problem of user studies.

I have already noted the growing dependence of advanced societies upon their collective memories of record. Individuals, too, can carry only a limited proportion

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[13] Joseph Becker, "Tomorrow's Library Services Today," News Notes of California Libraries 63: 430-31 (Fall, 1968).

of the world's knowledge in mind even in narrow specializations. The larger the number of people and the greater their dependence upon the record, the greater the burden upon information services. Data on the number of users of science and technology data and documents were recently published by SDC.[14] Similar data should be developed about users in other fields. There is real concern about the ability of future information networks to cope with the demands that will be made upon them. Certainly the present information systems are already in trouble.

Further demands upon information networks could, however, be influenced as much by the democratization of information services as by increasing numbers of special categories of users. In some societies--perhaps most at one time or another--access to libraries has been a privilege reserved for an educated élite, those who have earned or inherited the privilege, who bear the social responsibilities, and who hold the power. More recently, access to information has been claimed as the right of everyman for purposes of universal enlightenment, regardless of his social class, ability, or responsibility. In Western concepts of democracy power resides not with a privileged élite but with an educated and informed populace. One could go a step further and postulate that in advanced, technological societies, information becomes not just a privilege or a right but a necessity for essential social and national purposes. A sense of national urgency now pervades many library and information programs not only in the United States but also in certain developing countries, where the goal may not be so much to foster individual rights as to train the manpower required for the achievement of national goals, such as health, economic welfare, and security under threat of war. But whether because of individual rights or national imperatives, information should be as widely available as possible to all the people.

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[14] System Development Corporation, National Document-Handling Systems for Science and Technology (New York: Wiley, 1967), p. 116-17, 296-98.

One of the goals of library and information networks should therefore be more realistic and effective access to information resources, wherever they may be, for every citizen.[15] Weinstock set a similar goal for special libraries: "Every library should provide every patron with any published information required."[16] As in the acquisition of the total information resource, the ultimate goal can probably never be reached. Not all parts of the total resource could probably ever be made immediately accessible to everyone, but there is a continuum along which each man's opportunity can be measured.

The principle of equality of access to information everywhere raises some real problems. People are accustomed to thinking of local library and information centers as more or less self-sufficient resources to satisfy local needs, and many centers reflect those needs with remarkable sensitivity. But we are still stuck with the notion that the need varies with numbers of people, or with the size and wealth of communities. Smaller, poorer communities are presumed to need less. Larger, richer communities are presumed to need more. There are certainly valid differences among community needs on the basis of subject interests and emphases, but the principle of "books per capita" should be persuasively investigated. The college freshman, the engineer, the school teacher, the doctor, and the business man in rural, north-mountain California have no less need, as individuals, of the total resource than do their counterparts in the San Francisco-Bay Area. The basis of need is not political, geographic, demographic, or economic; it is personal; and the need finds expression not simply as a relationship between a community and its locally supported library but as one between the individual, wherever he may be, and the total information resource, wherever it may be.

For people everywhere, moreover, realistic and effective access should mean

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[15] R. C. Swank, Interlibrary Cooperation under Title III..., p. 47.

[16] Melvin Weinstock, "Network Concepts in Scientific and Technical Libraries," Special Libraries 58: 330 (May-June 1967).

their ability to discover, at any local point of contact with the information network, what books and information are available from the network, and then to get prompt delivery, also at the point of contact. Here again the ideal may never be fully achievable, but progress could be made along this continuum by means of computer and communications applications to the dissemination of bibliographical information on the one hand and to document delivery on the other.

The existing inequities of realistic access to information throughout the country are staggering;[17] and they merit our most serious study. They involve, of course, a wide range of categories of users. Our concern is not only with scientists, engineers, and professionals in other critical fields but also with the lay public, including the underprivileged. We are concerned with non-users of information as well as with users. We are concerned with education,[18] business, and recreation as well as research.

For all these categories of users, a further concern is the paucity of data about their information problems and needs. A careful analysis of user studies in the fields of science and technology by SDC revealed a number of useful recent studies but also pointed out the limitations of most of them.[19] Almost all the studies used questionnaires and interviews with scientists to ask what they think or say they need at some point of time. One wonders if other methodologies could be developed to assess the needs of scholars, such as, say, an analysis of a field of scholarship itself; its goals, the types of research done, the kinds of data used and the methodologies of their use, the sources of data, and so on, all of which points are germane to the general structure of an information system. More

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[17] For data on California see Swank, Interlibrary Cooperation under Title III..., pp. 7-17.

[18] EDUNET; Summer Study in Information Networks, conducted by the Interuniversity Communications Council (EDUCOM)...(New York: Wiley, 1967).

[19] SDC, National Document-Handling Systems..., p. 102-12.

studies are also needed of other categories of users, such as suburban communities, the public schools, rural neighborhoods, small business organizations, and the ghettos. Such studies should supply criteria for the design and the evaluation of information networks.

The major concerns, then, in the area of users include:

4. The growth in numbers of users and in the varieties of their information needs.
5. Equality of access by individual users to information resources everywhere, including realistic and effective service at local points of contact with the information network. The inequalities of existing access.
6. The categories of users and the range of purposes that information networks should serve.
7. User studies of the various kinds of readers to be served, as criteria for the design and evaluation of information networks.

Intellectual Access

The next broad area of concern is intellectual access to documents and data or, in conventional library terminology, bibliographical organization. I will not give much space to this area because of its great complexity; but it is, I believe, the really unique, gut problem of any library or information service. The communications and computer technologies for information network development are already at hand, but the logical means of organizing the information resource for discriminating access are not. The intellectual problems far outweigh the technological.

One way to express this problem is to postulate a direct relationship between the size of the data base and the selectivity required in its intellectual organization through catalogs, indexes, bibliographies, or other schemes. The

larger and more varied the information resource to which access is desired, and the greater the numbers and heterogeneity of users who need access, the more refined, sensitive, flexible, and discriminating must be the schemes of intellectual organization. These schemes are like sieves that sort huge quantities of grossly related things into sequentially smaller quantities of more closely related things, until what is pertinent to a special need is sifted out. The Library of Congress classification and dictionary catalog are already tremendously complex sets of sieves, but the schemes that would be needed from a nationally integrated network of the total information resource are still almost unthinkable.

This problem, it appears, would be exaggerated by mechanized retrieval systems unless highly reactive, or interactive, schemes became practicable. Our traditional manual schemes permit a user to enter and reenter the system at different points, to narrow or broaden his search strategies, to browse, and to select as many or as few references as he wants. A similar capability must be built into mechanized systems, and, indeed, impressive progress has already been made. But there are still big bottlenecks in the logic of the structure of very large files and in the programs for reorganizing stored information in response to the differing and changing needs of users.[20]

The reactive process, moreover, must occur where the user is--again, at his local contact with the information network--either by means of manually searched catalogs produced by machine for distribution to local service points or by means of direct interrogation of computer files.

There is a plethora of problems behind these broad concerns: the concepts

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[20]Carter, "What are the Major National Issues...," p. 408, 416; Joseph Becker, "The Future of Library Automation and Information Networks," in Library Automation; a State of the Art Review; Papers Presented at the Preconference Institute on Library Automation Held at San Francisco, Calif., June 22-24, 1967, under the sponsorship of the Information Science and Automation Division of the American Library Association (Chicago: A.L.A., 1969), p. 1-6.

and terms around which documents and data are organized, and the derivation of those concepts and terms; their arrangement for speedy access; the rules by which documents are entered under them or by which they are assigned to documents; and so on and on. Automatic associative indexing and question-answering systems are possibilities, but still in the future for large scale applications. Major new insights into the logical problems of information organization will be required before the network capabilities of electric signal transmission can be fully exploited.

Our concerns here are primarily:

8. The further refinement of existing schemes, or the creation of new and more sensitive ones, for intellectual access to the hugely augmented information resources to become accessible through information networks.
9. In particular, the development of reactive, flexible, mechanized retrieval systems that simulate the user's interchange with manual systems.

Physical Access

By physical access I mean the getting of copies, in whatever form, of the documents or data selected through the process of intellectual access. Our concern is that the information network be able to supply copies, within reasonable periods of time, for users who want them. I suspect that, on the whole, this is a much less critical concern than intellectual access. Many users might want only the bibliographical references, or abstracts, and others might be in no great hurry for the full texts. But the modern information network should have as one of its goals the prompt location of desired documents or data anywhere in the country and the delivery of some of them, or parts of them, by such means as long distance facsimile transmission, computer print out,

or CRT display, as well as by conventional interlibrary loan. The potentially huge volume of traffic along these delivery lines might necessitate rigorous priorities.

In future fully automated networks, physical access might form a single continuum with intellectual access. A reactive system of intellectual access might be able to display not only conventional bibliographical references but also annotations, abstracts, and selected segments of the text (as microfilms are scanned); then, desired parts of the work, or the whole of it, could be printed out. The potential spectrum of representation of a document extends from brief citation to full text. For a good long while, however, the practicable methods of physical access appear likely to remain separate from those of intellectual access and to employ different kinds of equipment.

Our main concern is:

10. The prompt location of desired documents or data anywhere in the country and the delivery of copies, within appropriate periods of time, to users at local outlets of the network.

Formal Organization

The preceding areas were mainly related to objective concerns--the why, the who, and the what of information networks. I now turn to the operating agencies that comprise service systems and networks and the organizational structures that bind them together. This is a large, practical area that, together with technological concerns, will probably dominate the discussions at this conference.

To Becker and Olsen a formal network organization occurs when "many units sharing a common information purpose recognize the value of group affiliation and enter into a compact."[21] I would add that such organizations are often

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[21]Becker and Olsen, "Information Networks," p. 290.

conceived also as having hierarchical levels of cooperating units and affiliations. From any local service point, the search for documents and data might rise, if need be, through several layers of cooperating information systems--local, regional, national, or even international--each system at each level having its own communications center or node. The network idea, in a sense, is the full modern extension of a drive that began many decades ago to organize larger units of public library service, a drive that has resulted in county, regional, and, to a certain extent, state-wide public library systems. Characteristically, such organizations consist of centers or nodes of local service that are then affiliated under second-level centers or nodes with higher switching capabilities, and so on. Theoretically, at least, the ultimate national network should have some sort of super-node at the apex of the hierarchy.

One major concern, then, is the conformation of such hierarchical organizations. What, for example, would be the optimum size of systems at each level of the network? What would be the best balance between resources that are locally available from any particular node and those that must be sought through nodes at higher levels? What levels of local sufficiency would be most cost-effective, given varying levels of back-up capability? For network purposes, how should a region be defined? What would be the functions of a regional center or node? Under what circumstances should requests for service by-pass regional or other intermediate nodes and proceed directly to coordinate or higher nodes? At what levels of centralization should certain technical processes occur, such as accounting, circulation control, and the production of union lists? There has been a great deal of pragmatic experience with these and similar concerns, but the general conformation of network organizations has, to my knowledge, received very little systematic study.

More attention has been paid to the kinds of information agencies that should be banded together. Separate cooperative systems may be formed by type of library or information center, such as public, academic, or special libraries; by

form or medium of record, such as technical reports, motion picture films, or journals; or by discipline, such as medical, agricultural, or chemical information services. Title III of the Library Services and Construction Act promotes cooperation among all types of libraries. Carter has argued that national networks might be developed most usefully along subject lines.[22] I have argued for mixed networks of geographical systems, embracing public, school, and small college libraries, with separate subject systems of special libraries, and with our great university and research libraries backing up all on a broad contractual basis.[23] The geographical boundaries of public and subject systems might differ greatly. Many patterns are possible, and perhaps no consistent pattern is needed, as long as the nodes of each system are in communication with each other, so that public systems may be served also by subject systems, subject systems by media systems, and so on. The real-life mosaic of special interest systems that will comprise the information network of the future could be very complex indeed.

Another problem is the nature of the compacts that bind governmental units, public and private institutions, and business and industrial organizations together for the common purpose of sharing information. What legal bases have been or could be used for financial and service agreements? What is offered, what is received, and by what accounting?

More fundamental is the problem of overall responsibility for and control of information networks, particularly at the national level. Some sort of central coordination, either by a federal agency or by a national commission, seems needed.[24] The federal and state governments have a basic responsibility for the equalization of information service opportunities and a financial interest in the performance

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[22]Carter, "What are the Major National Issues...," p. 410-11.

[23]Swank, Interlibrary Cooperation under Title III..., p. 61-68.

[24]Hoshovsky, "COSATI Information Studies...," p. 403.

and promise of information networks.[25] Yet the contributions and interests of the private sector must be respected and protected. No satisfactory formula has yet been evolved for the allocation of these reponsibilities, but some observers believe still that modern information networks of national scope are not likely to be built until the federal government has been persuaded to finance them.[26]

Planning at the national level is certainly essential. In the last two decades, wave after wave of national document-handling plans have been advanced by various agencies. Fifteen of the best known plans were reviewed by SDC.[27] Most of them concentrated on the organizational aspects of the national information problem, few dealt with the acquisition of resources, the needs of users were generally overlooked, relatively little attention was paid to technical problems, and still less attention, perhaps, was devoted to existing operating library systems.

The experience of existing library and information systems should not, I think, be neglected in the design of national networks. The SDC analyzed a selection of federal and nonfederal libraries; information analysis centers; publication, announcement, and distribution groups; document generators/users; and administration, policy, and support groups in the fields of science and technology.[28] This analysis is impressive, and similar studies of information agencies in other fields would be most helpful. So also would be equally thorough studies of the evolving patterns of cooperative systems and networks. Some surveys

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[25] William G. Colman, "Federal and State Financial Interest in the Performance and Promise of Library Networks," in University of Chicago, Graduate Library School, Library Networks--Promise and Performance, the 33rd Conference...July 29-31, 1968 (Chicago: University of Chicago Press, 1969), p. 99-108.

[26] Carter, "What are the Major National Issues...," p. 416-17.

[27] SDC, National Document-Handling Systems..., p. 129-89.

[28] Ibid., p. 7-69.

have been made,[29] and these are revealing, even though they are often more discursive than systematic.

The national planners would often impose entirely new networks from above, on the assumption that the tortuously evolving efforts from below have failed. The revolutionary tends to by-pass due process. The evolutionary prefers to build upon existing institutions, which are, for better or worse, the only operational ones we know. Perhaps both approaches are needed--planning from above and building from below--, each with full appreciation of the other.

In support of the evolutionary approach certain points can be made. This is the real-life world of information service, the best yet. A national document system that tried to ignore it might wash down the drain because of the absence of grass-roots delivery facilities. The understructure of local facilities, educated and experienced staff, and even informed readers is indispensable. The proof of any network is the goods actually delivered to people who understand what they can ask for from staff who know how to get it through well developed organizations at the local level.

In support of national planning, certain other points can be made. Existing institutions are bound by tradition and motivated by self-defense. They eschew new ideas and technologies that disturb their sense of security and success. They fail to face the future. The only way to get on with the business is to create de novo new systems based on broader concepts that exploit more advanced technologies.

There is some truth, I suggest, in both positions, but not the whole truth in either. Within the realistic economic and social constraints of operating library and information services, new ideas and technologies have, in fact, been readily espoused. But the more revolutionary ideas and technologies that are not yet achievable within those constraints have been understandably resisted. Revolutionary

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[29] E.g., G. Flint Purdy, "Interrelations among Public, School and Academic Libraries," in Univ. of Chicago, Graduate Library School, Library Networks..., p. 52-63; and William S. Budington, "Interrelations among Special Libraries," in ibid., p. 64-77.

approaches might be possible, but only, and then not likely, by the intervention of such a deus ex machina as the federal government.

So, our areas of concern under the rubric of formal organization include:

11. The conformation of network structures. The optimum size of systems at each level. The balance between local and back-up resources. Centralized processing, and so on.
12. The kinds of information agencies to be formed into systems. Geographical, type of library, media, and subject systems. The linking of mixed systems into networks.
13. The compacts that bind information agencies together into systems. Financial and service agreements.
14. Responsibility for and control of information networks. Contributions of the governmental and private sectors. The federal government and national network development.
15. Planning for national networks. The need of new national structures.
16. Evolution of existing cooperative systems and networks. The importance of building upon operational experience.

The New Technologies

Earlier in this paper I noted that the modern information network would be new and different primarily in its technological power to extend tremondously a set of elemental functions that started in the personal, home library. These extensions of power should enable us to amass larger data bases without filling miles and miles of book shelves, to search them more deeply without thumbing millions of catalog cards, and to obtain copies of documents without travelling across the country or sending for them by mail. Telecommunications and computers, in particular, are magnificent tools that should help us in our trade, as the

hammer helps the carpenter.

There are many kinds of new technological developments in such fields as document miniaturization and reprography, printing, and audio and visual techniques, all of which are of general interest to us. But for network development our primary concerns are telecommunications and computers. These are the particular tools that encourage us to plan toward national information networks that might in fact bring true the century-old dream of interlibrary cooperation. It is the potential power of their application to information services that has justified this conference.

Becker gave us a brief description of modern telecommunications devices, classified by type of signal (audio, digital, and video) and by signal carriers (telephone lines, radio broadcasting, coaxial cable, microwave, and communications satellites).[30] For the technological layman, like myself, he also reviewed in simple terms the history and significance of the computer inteface with communications. He described the growing capacities of telephone lines; the advent of wide-band facilities that will easily accommodate the language of the TV camera, the facsimile scanner, the teletype machine, and the computer; the role of switching stations; and the nature and potentialities of satellites. He then illustrated the use of communications for remote access to computer-manipulated data bases, including audio as well as digital messages.[31] The wedding of on-line computers with communications networks and remote user terminals is the key to expanding information services through network development.

It would be presumptuous of me to undertake any discussion of these technological developments. The latest developments were covered by Overhage in

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[30]Joseph Becker, "Telecommunications Primer," Journal of Library Automation 2: 48-56 (September 1969).

[31]——, "Tomorrow's Library Services Today," p. 429-36.

the 1969 Annual Review.[32] Taking my cues partly from him, I will outline briefly the following major areas of our concern:

There is first the general need for the further development of communications and computing capabilities as they relate specifically to large scale document and data handling systems. I refer particularly to storage capacities, reactive retrieval systems, and high-speed, high-data-rate, low-cost communications channels.

Second is the need of further applications to operating information systems at various levels, from relatively simple teletype and facsimile transmission through computer-communications configurations. Such experiments should certainly include mixed systems that might be based, for example, partly on computers, partly on microforms of one kind or another, and partly on conventional texts. A "pure" computer-communications network might never be technically or economically feasible in the field of information services. The most fruitful immediate computer applications appear to be in the area of intellectual access to, or bibliographical organization of, documents and data.

A third broad problem is the compatibility of machine systems. The difficulties of arriving at standards and formats that can be used for the transfer of information between units of a cooperative system or network have been well demonstrated by the MARC project. Recent efforts to reach agreements and guidelines were reviewed by Overhage in his Annual Review chapter. A distinction should be drawn, I think, between flexibility in local record-keeping and conformity in the transfer of information among the units of a network.

Fourth is the problem of regulation. Existing communications networks are not well suited to information services, partly because of rate structures. High common-carrier tariffs and rigid controls over the use of communications utilities militate against information network development. The growing interdependence of

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[32] Overhage, "Information Networks."

computers and communications has further complicated the issues of policy and control.

Fifth is copyright, which is a familiar problem with new twists in the computer field. For example, is the copyright law violated when a document is put into a computer data base or when it is displayed? Even the old issues of fair use and office copying are still unresolved. How, then, should the process of modifying texts, manipulating and consolidating their content, and displaying them in new ways be interpreted under the law?

And finally, there is the problem--and it is a tremendous one--of educating librarians and information specialists, on the one hand, and the user public, on the other, in the nature, operations, and values of modern technological network extensions of familiar library and information services. What should the library and information science schools contribute? What sorts of continuing education programs should be offered? What is the role of in-service training by operating agencies that are engaged in network development? These considerations, again, are major reasons for building gradually upon alert, experimental, existing agencies that can do the necessary educational job.

In summary, then, some broad concerns in this area are:

17. Further development of communications and computing capabilities for large-scale document and data handling operations,
18. Further applications to operating information agencies, including experimentation with mixed, as well as pure, information networks.
19. The adoption of compatible machine systems, standard formats, languages, etc.
20. The regulation of communications utilities in such ways as to permit their use by information networks in flexible ways at reasonable cost,
21. Resolution of copyright restrictions, including those relating to manipulations of texts by computer.

22. The education of librarians, information specialists, and the user public in the nature, operation, and values of modern information networks.

Conclusion

I have tried in this paper to identify and describe the large areas of concern at this conference. I have dealt lightly with the technological problems and more heavily with the functional problems because I know less about the former and the engineers among us know less about the latter. We will all have to adjust our attitudes toward information services if the networks of the future are ever to be created.

Those among us, like myself, who have operated existing services will have to revise in fundamental ways our conception of the operative information agency. Our conception of institutional responsibility limited primarily to supportive segments of society will have to give way to that of broader social obligations. While each library, for example, must attend to the interests of its own clientele, it can minister fully to those interests only if it recognizes that their range and depth often extend far beyond the resources locally available. The educational, cultural, and technical interests of a local clientele will often be poorly served by protecting the user's access to inadequate local collections at the expense of access to larger, richer reservoirs of the information resource.

The ideal of independent, locally self-sufficient programs must certainly give way to that of dependent participation in nationally sufficient programs. If national information networks were ever to be built, local libraries and information centers would have to be redefined as selective inlets to and outlets from those networks. The specifications, for example, of local acquisitional policy would need to be modified to reflect a new balance between resources that, on a cost-effectiveness basis, should be acquired at home and those that should be acquired

only upon demand from various levels of network service. If the information networks could ever in fact deliver the goods efficiently and promptly at local service points, the effects upon the nature of local libraries and information agencies would be profound indeed.

I assume, of course, that somewhere higher up in the network hierarchy, the national resource would in fact be acquired and controlled. This is a precarious assumption. Librarians have often pointed out that the cooperative enrichment of local library resources is a condition to useful cooperative service. A poverty of resources can be shared without information networks.

The information and communications engineers among us might revise their conceptions of the nature and role of information networks by paying more attention to the substantive problems of information service. Information networks are not just a technological challenge. For every advance in technological power, there must follow, if not precede, a corresponding advance in the conception of the functions to be advanced. In the world of library and information services, these functions are, and always have been, the acquisition of information resources, with all the problems of selection, storage, and purging; the intellectual organization of those resources through catalogs, bibliographies, indexes, and, lately, computer-based retrieval system; and the methods of physical delivery of copies of documents and data, all in the service of users whose needs should determine the goals of the service.

I hope that at this conference the engineers will listen to the practitioners who work with the information that networks will communicate, as I also hope that the practitioners will grasp the opportunity created by the engineers to pursue further their crucial social mission.

Our commodity, again, is not just documents and pieces of data; it is that growing part of our culture that is recorded, and therefore capable of being saved for recall as needed, our capacity to learn and remember having reached a human

limit. The recorded information resource, when adequately organized and communicated, should become one of the greatest utilities of advanced societies.

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